

WHAT IS CLAIMED IS:

- 1 1. A method for alignment of one or more waveguides, comprising:
2 inserting a plug into one or more through holes in a carrier;
3 attaching one or more waveguides to the carrier;
4 aligning the carrier to align the one or more waveguides with respect to an optical
5 device attached to a substrate; and
6 tacking one or more of the plugs to the substrate to maintain the alignment of the one
7 or more waveguides with respect to the optical device.
- 1 2. The method of claim 1 wherein the carrier is made from a ceramic material.
- 1 3. The method of claim 1 wherein the one or more waveguides are attached to the
2 carrier using an adhesive, soldering or welding.
- 1 4. The method of claim 3, further comprising heat curing or UV curing an
2 adhesive used to attach the one or more waveguides to the carrier.
- 1 5. The method of claim 1 wherein the waveguide includes an optically
2 transparent medium, a fiber array having one or more optical fibers, or a lens
3 array having one or more lenses.
- 1 6. The method of claim 1, wherein the waveguide includes, one or more active
2 and/or passive optical elements.
- 1 7. The method of claim 6, wherein the optical elements are capable of
2 attenuating, amplifying, switching, translating or routing photonic energy in
3 one or more frequencies.
- 1 8. The method of claim 1, further comprising tacking one or more of the plugs to
2 the carrier.
- 1 9. The method of claim 8 wherein the plugs are tacked to the substrate using an
2 adhesive.

- 1 10. The method of claim 1 wherein the plug is characterized by a smaller diameter
2 than the corresponding hole such that an angle of the carrier relative to the
3 substrate may be adjusted by up to 45°.
- 1 11. The method of claim 10 wherein the angle of the carrier relative to the
2 substrate may be adjusted by up to about 5°.
- 1 12. An apparatus for aligning one or waveguides to one or more optical devices,
2 comprising:
3 a carrier having one or more through holes, the carrier being adapted to receive the
4 one or more waveguides;
5 one or more plugs, each of which is sized to be received in one or more of the
6 through holes;.
- 1 13. The apparatus of claim 12, further comprising a substrate.
- 1 14. The apparatus of claim 12 wherein the holes are sized such that the plugs have
2 sufficient clearance to slide within the holes without excessive insertion force.
- 1 15. The apparatus of claim 12 further comprising a waveguide attached to the
2 carrier.
- 1 16. The apparatus of claim 15 wherein the one or more plugs are inserted into the
2 one or more holes.
- 1 17. The apparatus of claim 16 wherein one or more of the plugs are attached to the
2 carrier.
- 1 18. The apparatus of claim 17 wherein one or more of the plugs are attached to a
2 substrate.
- 1 19. The apparatus of claim 12 wherein the carrier is transparent to ultraviolet light.
- 1 20. The apparatus of claim 19 wherein the carrier is made from a ceramic or glass
2 material.
- 1 21. The apparatus of claim 20 wherein the carrier is made from fused silica or
2 Pyrex.

- 1 22. The apparatus of claim 12 wherein the waveguide includes an optically
2 transparent medium, a fiber array having one or more optical fibers, or a lens
3 array having one or more lenses.
- 1 23. The apparatus of claim 12 wherein the waveguide includes, one or more active
2 and/or passive optical elements.
- 1 24. The apparatus of claim 23 wherein the one or more active and/or passive
2 optical elements are capable of attenuating, amplifying, switching, translating
3 or routing photonic energy in one or more frequencies.
- 1 25. The apparatus of claim 12 wherein the plug is characterized by a smaller
2 diameter than the corresponding hole such that an angle of the carrier relative
3 to the substrate may be adjusted by up to 45°.
- 1 26. The apparatus of claim 25 wherein the angle of the carrier relative to the
2 substrate may be adjusted by up to about 5°.
- 1 27. An apparatus for attachment and alignment of optical devices to a motherboard
2 comprising:
3 a) at least one device carrier;
4 b) at least three adjustable plugs configured to fit into openings in the device
5 carrier or in the motherboard; and
6 c) a filler material that fills the space between the device carrier and the
7 motherboard;
8 d) wherein the plugs closely fit into the openings, such that a clearance is large
9 enough for the plugs to slip through the openings without much insertion force
10 and the clearance is small enough that the plugs may be held in place by the
11 force of friction.
- 1 28. The apparatus of claim 27 wherein the clearance between the plugs and the
2 openings is 50μm or less.
- 1 29. The apparatus of claim 28 wherein the carrier is transparent to ultraviolet light.
- 1 30. The apparatus of claim 29 wherein the carrier is made from a ceramic material.